

Application No. 09/838,684

REMARKS

In an Office Action dated December 10, claims 1, 8, 19, 23 and 26 were rejected under 35 U.S.C. 112 second paragraph as being indefinite for using the word "predetermined" which was held to be vague and indefinite. In response, Applicant has removed the word "predetermined". Claims 11 and 25 were held to be vague and ambiguous for using trademarked products. In response, Applicant has substituted the chemical name or the generic term for the trademarked product.

In the Office Action, claims 1-30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Jang et al. (U.S. patent 6,401,002) in view of Wolf, S (Silicon processing for the VLSI Era, vol. 1, pp. 564-565). Applicant respectfully disagrees and submits that the two references are insufficient to create a prima facie case of obviousness.

In order to create a prima facie case of obviousness, each element of the claim must be shown in the prior art. All of the independent claims including claims 1, 19, 23 and 26 disclose an etching process including deposition of droplets to form a mask and removal of the mask. None of the prior art references discloses ejecting droplets to form a mask using a phase change material. The prior art references cited merely describe a deposition system to fabricate free-form three dimensional objects and a standard VLSI reference text that describes plasma etching a substrate. Furthermore, no suggestion to combine has been provided that would lead one of ordinary skill in the art to adapt a machine for fabricating free form three dimensional objects to generate two dimensional masks for masking semi-conductor surfaces.

Forming a three dimensional structure using wax is very different than forming a line to be etched. The Jang reference includes limitation such as waiting for the layers to dry before depositing subsequent droplets. Jang Col. 15, lines 3-5. In contrast, Applicant when depositing a line adjusts the temperature to increase coalescence between adjacent drops. Page 7, lines 10-12. In semiconductor processing, even minor breaks in a mask line can result in an unusable structure. Even uneven line thickness can result in breaks in the line during etching. Thus, Applicant respectfully submits that one of ordinary skill in the art would not use a process

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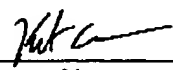
for forming bulk 3-D objects that calls for depositing layer upon layer after the droplets freeze to a delicate semiconductor process.

A prima facie case of obviousness also has not been raised with respect to many of the dependent claims. For example, limitations such as those in claims 12 and 13 that cite specific temperature characteristics and vapor pressure characteristics of the masking material would be unimportant in fabricating a 3-d structure. Such omissions should be expected since neither reference discloses or suggests using droplets of phase change material in a semiconductor masking process. Claim 16-18 which discloses a feedback system based on droplet spreading and wetting characteristics is also not shown in the prior art. Again, such characteristics probably are not critical in the formation of 3-D structures for non-semiconductor use.

Other claims, such as claim 8-10, were summarily rejected because it was stated that depositing a second layer merely repeated the prior steps. However, that assertion ignores the fact that prior to depositing the second layer, the Applicant also claims etching the substrate and removing the first layer, something directly opposite of what Jang teaches which is to make sure the first layer has frozen before depositing the second layer to create a three dimensional structure of wax layer upon wax layer.

In view of the preceding amendments and remarks, Applicant respectfully submits that the claim as amended are allowable over the cited prior art reference, and allowance at Examiner's earliest convenience is hereby respectfully requested. In the event that the Examiner believes a teleconference would facilitate prosecution, Applicant respectfully requests that Examiner contact the undersigned.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE:**IN THE SPECIFICATION:**

Please insert the following on Page 1, line 2 before "Background of the Invention":

STATEMENT OF RELATED APPLICATION

This application is related to patent application serial number 09/838,685 entitled "Apparatus for Printing Etch Masks Using Phase-Change Materials" also filed on April 19, 2001 and U.S. Patent Application serial number 10/334,595 entitled "Inexpensive fabrication of Large-Area Pixel Arrays for Displays and Sensors" filed December 30, 2002.

IN THE CLAIMS:

Please substitute the following for amended claims 1, 8, 11, 19, 23, 25 and 26 and add the new claims 31-32.

1.(Amended) A method of masking comprising the operations of:

maintaining a surface to be etched below the freezing temperature of a phase-change masking material;

ejecting in liquid form droplets of the phase change masking material in a ~~predetermined~~ pattern on the surface to be etched, the droplets changing from a liquid to a solid after contact with the surface to form a first mask;

etching the surface to remove material from around said first mask to create a first etched surface; and

removing the first mask from said first etched surface.

8. (Amended) The method of claim 1 further comprising the operations of:

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depositing a second layer to be etched over the etched surface;

maintaining the second layer to be etched below the freezing temperature of a second phase-change masking material;

ejecting in liquid form a second plurality of droplets of the second phase change masking material in a second predetermined pattern on the second layer to be etched, the second plurality of droplets changing from a liquid to a solid after contact with the second layer to form a second mask;

etching the second layer to remove material from around said second mask to create a second etched surface; and

removing the second mask from said second etched surface.

11. (Amended) The method of claim 1 wherein the phase-change masking material is a ~~Kemamide based wax~~ stearyl erucamide mixture solution.

19. (Amended) A method of patterning a thin film comprising the operations of:

depositing a thin film;

depositing droplets of a phase change masking material with a freezing point between 50 and 100 degrees centigrade in a predetermined pattern on the thin film;

etching the thin film to remove portions not protected by the droplets of the phase change masking material; and

removing the droplets of the phase change masking material from the thin film.

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23. (Amended) A method of performing a masking process comprising the operations of:

depositing a coating of photosensitive material on a substrate to be patterned;

maintaining the coating of photosensitive material at a temperature below the freezing point of a phase-change material;

depositing droplets of phase-change material on the photosensitive material in a ~~predetermined~~ pattern;

exposing the photosensitive material not protected by the phase change material to ultraviolet light;

removing the phase change material; and,

removing the photosensitive material on the substrate not exposed to the ultraviolet light.

25. (Amended) The method of claim 23 wherein the spin-on polymer is SU-8 a photosensitive polymer.

26. (Amended) A method of masking comprising the operations of:

maintaining a temperature of a surface to be etched above the boiling point of a liquid carrier, said liquid carrier including a suspended masking material;

ejecting in liquid form droplets of a solution including the liquid carrier and suspended masking material in a ~~predetermined~~ pattern on the surface to be etched, the liquid carrier rapidly evaporating after contact with the surface leaving the masking material to form a first mask;

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etching the surface to remove material from around said mask to create a first etched surface; and

removing the mask from said first etched surface.

Please add new claim 31 and 32

31. (New) The method of masking of claim 1 wherein the temperature is maintained high enough to allow adjacent deposited drops to coalesce before freezing.

32. (New) The method of claim 31 wherein a series of adjacent drops form a line to enable etching a straight line.